

**APPARATUS AND METHOD FOR PASSIVE ADAPTIVE FLYING HEIGHT
CONTROL IN A DISC DRIVE**

WHAT IS CLAIMED IS:

Sub Q 1 1. A suspension for adapting flying height of a read/write head due to changes in temperature in a disc drive, the suspension comprising:

- a load beam;
- a gimbal positioned at one end of the load beam;
- a slider attached to the gimbal, wherein the head is fixed to the slider; and
- a shape memory alloy segment attached to the gimbal.

10 2. The suspension of claim 1 wherein the shape memory alloy segment comprises nickel-titanium.

15 3. The suspension of claim 1 wherein a distal end of the gimbal has two parallel flexure beams connected by a cross beam, and the cross beam defines an attachment pad that is secured to a top surface of the slider.

20 4. The suspension of claim 3 further comprising a second shape memory alloy segment attached to the gimbal, wherein one shape memory alloy segment is attached to each of the flexure beams of the gimbal.

25 5. The suspension of claim 3 further comprising a plurality of shape memory alloy segments attached to each of the flexure beams to span a substantial portion of the length of the flexure beams.

30 6. The suspension of claim 3 further comprising nine additional shape memory alloy segments attached to the gimbal, wherein five shape memory alloy segments are attached to each of the flexure beams of the gimbal.

7. The suspension of claim 6 wherein each of the five shape memory alloy segments on each of the flexure beams has a different transition temperature.

8. The suspension of claim 7 wherein the transition temperatures comprise: 40°, 50°, 55°, 60°, and 65° Celcius.
 9. The suspension of claim 3 wherein the gimbal is attached to a lower surface of the load beam.
 10. The suspension of claim 3 wherein the gimbal is attached to an upper surface of the load beam.
 11. The suspension of claim 3 wherein the gimbal is integrated with the load beam.

12. A disc drive comprising:

a head disc assembly having a base plate and a top cover enclosing a drive motor carrying a disc and an actuator assembly having an actuator arm;

5 to the actuator arm; and

at least one shape memory alloy segment attached to the suspension for moving the slider between a contracted state away from the disc when temperature within the head disc assembly increases and a relaxed state near the disc when temperature within the head disc assembly decreases.

10 13. The disc drive of claim 12 wherein the shape memory alloy is nickel-titanium.

14. The disc drive of claim 12 wherein at least three shape memory alloy segments are attached to opposite sides of the suspension.

15 15. The disc drive of claim 14 wherein each of the shape memory alloy segments on each side of the suspension are composed of a different shape memory alloy.

16. The disc drive of claim 14 wherein each of the shape memory alloy segments on 20 each side of the suspension have a different transition temperature.

17. The disc drive of claim 12 wherein the suspension comprises:

a load beam having a proximal end and a distal end, wherein the proximal end is attached to the actuator arm, and the distal end forms a tongue having a dimple formed on a 25 lower surface of the tongue for transferring a preload force to the slider; and

a gimbal attached to the distal end of the load beam, one end of the gimbal forming a cutout region bordered by two side arms and a cross beam, the cross beam defining an attachment pad attached to the slider, wherein the dimple of the load beam protrudes through the cutout region to make contact with the slider and to permit the slider to pivot about 30 the dimple.

18. The apparatus of claim 17 wherein a plurality of memory alloy segments are attached to each of the gimbal side arms.

19. The apparatus of claim 18 wherein the shape memory alloy segments are centered about the dimple.

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20. An apparatus for providing passive control of flying height of a slider over a disc within a head disc assembly in a disc drive, the head disc assembly having a base plate and a top cover enclosing a drive motor about which the disc spins and an actuator assembly having an actuator arm, the apparatus comprising:

5 a suspension having one end connected to a slider and an opposite end connected to the actuator arm, wherein the slider flies above the disc at a predetermined flying height; and

10 means attached to the suspension for increasing the flying height of the slider when the temperature in the head disc assembly increases and decreasing the flying height of the slider when the temperature decreases.

21. The apparatus for claim 20 wherein:

15 the suspension comprises a load beam attached at one end to the actuator arm and a gimbal positioned at another end of the load beam, wherein the means is attached to the gimbal.

22. The apparatus of claim 20 wherein the means comprises:

at least one shape memory alloy segment.

20 23. The disc drive of claim 20 wherein the means comprises:

15 at least three shape memory alloy segments attached to opposite sides of the suspension.

24. The disc drive of claim 20 wherein the means comprises:

25 at least one nickel-titanium segment.